

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN SECTIONS
OF LIGHTS CREEK, PLUMAS COUNTY, 1994

by

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INTRODUCTION

In 1976, the Department of Water Resources (DWR) initiated an instream flow program to identify streams that would benefit from flow enhancement. The Northern District of the DWR selected Indian Creek below Antelope Reservoir as one of the streams to study under this program. Initial flow studies by the DWR indicated that flow augmentation could double trout habitat in the first 16 km of Indian Creek below the dam and increase habitat by 25 percent in lower reaches (DWR 1979). As a result of this study, the DWR reoperated Antelope Reservoir in March 1978 to increase flow releases from 0.1 cms to 0.6 cms year-round to enhance recreation and fishery values (Hinton 1983). Brown (1993) reported that increased flows had increased trout standing stocks and numbers of catchable trout.

The DWR sponsored investigations to determine the status of trout populations in tributaries to Indian Creek. We sampled fish in Lights Creek (Figure 1) in September, 1994. Other tributaries sampled as part of this program include Red Clover Creek (Brown 1976, Brown 1990, Brown 1991), Hungry Creek (Brown 1992a), Little Grizzly Creek (Brown 1992b), and Ward Creek (Keeney and Brown 1992). These creeks were sampled to provide information on trout life history and growth that will allow Indian Creek to be managed in a manner that will provide the best

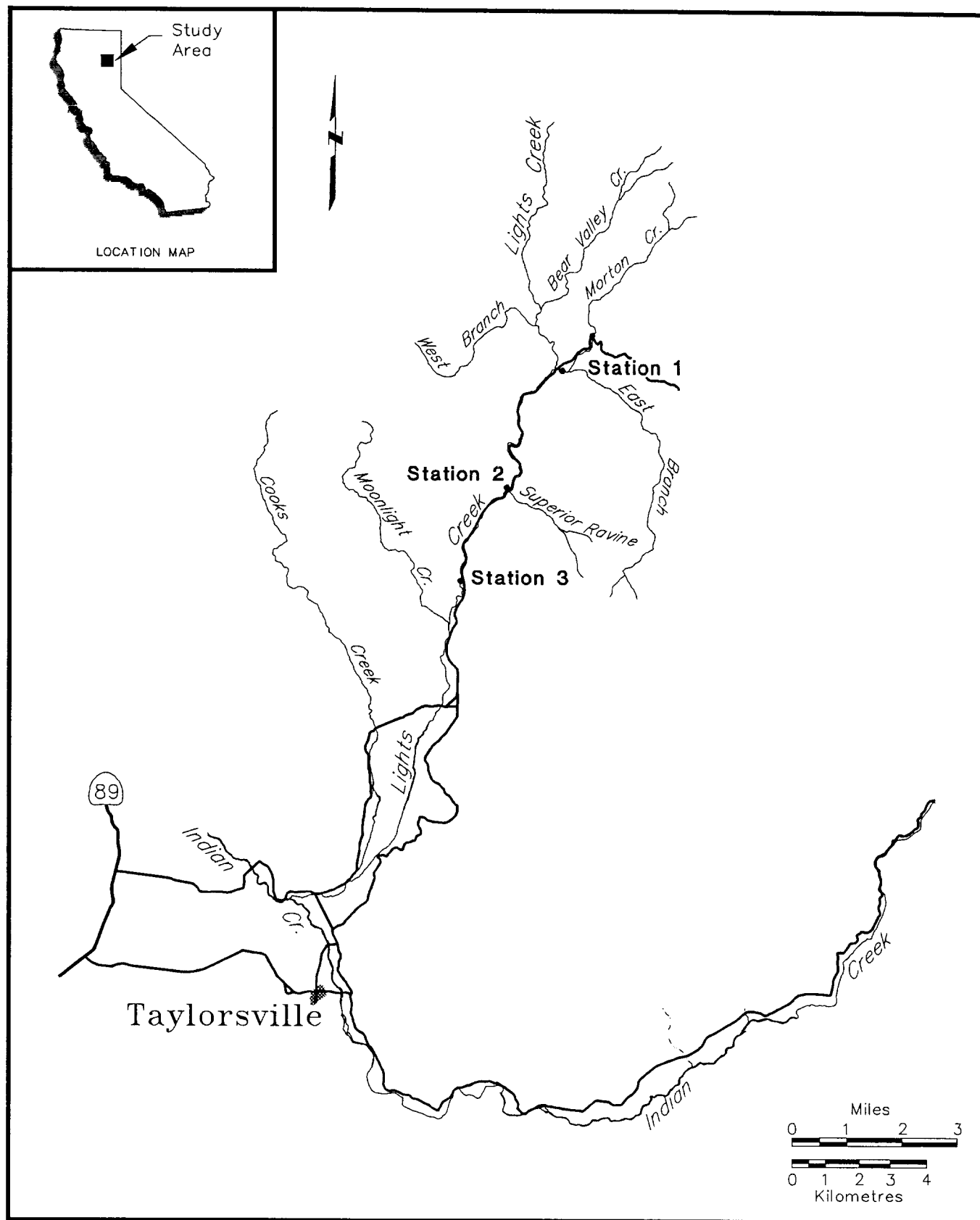


Figure 2. Stations sampled to estimate standing stocks of fish in Lights Creek, Plumas County, 1994.

habitat for trout reproduction and survival. This is the first time Lights Creek has been sampled as part of the Indian Creek studies.

STUDY AREA

The Lights Creek study area extends from the headwaters of Lights Creek to its mouth near Taylorsville (Figure 1). The stream flows through rocky canyons and relatively flat areas covered with cobbles left from mining activities. Elevation in the study area averages 1225 m. Steep hillsides surrounding the stream are covered with pine, cedar, and fir trees. Trees that border the stream are predominantly alder. Lights Creek flows through a man-made irrigation channel in its lower 10 km. In this reach it has soil banks and a mud bottom. Lights Creek averages 7.8 m wide in the reach above Moonlight Creek at 0.08 cms.

Two species of fishes were caught in this study: rainbow trout (Oncorhynchus mykiss) and Sacramento sucker (Catostomus occidentalis).

METHODS

Physical Measurements

Standing stocks of fishes were estimated at three stations in Lights Creek (Figure 1). Stations varied in length from 52.0 to 68.0 m (Appendix 1). The length and width of each station was measured with metric tape measures. The depth of water was determined by measuring water depth at the center of five equally spaced intervals across five transects at each station.

Biological Measurements

Fish were captured with a battery-powered backpack electroshocker in stream sections blocked by seines as described by Platts et al. (1983). Captured fish were removed from the net-enclosed section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967) or the multiple-pass method of Leslie and Davis (1939) with limits of confidence computed using a formula proposed by DeLury (1951).

The weights of trout were measured by displacement. Fork length (FL) of each fish caught was measured to the nearest millimeter.

Scale samples were taken from rainbow trout 100 mm or greater FL. Scales were taken just above the lateral line between the dorsal and adipose fin (Scarrnecchia 1979) and placed in a piece of paper inserted in a small coin envelope (Drummond 1966). Scales were mounted dry between microscope slides. Their images were projected on a NCR microfiche reader at a magnification of 42x. Scale measurements for the calculation of growth were recorded to the nearest millimeter along the anterior radius of the anterior-posterior axis of the scale. Estimation of instantaneous population growth rate was calculated (Ricker 1975) with significant values of correlation coefficients taken from a table (Steel and Torrie 1960).

$$\text{Instantaneous population growth rate} = b(\log_e l_2 - \log_e l_1)$$

- b = between ages functional slope
- l_1 = initial length for the last complete year of growth
- l_2 = final length for the last complete year of growth

Standing crops of rainbow trout were calculated for individual stations where each species was caught. Age and growth was calculated for the population (Everhart et al. 1975). Length-weight relationships were determined for rainbow trout (Lagler 1956). The coefficient of condition and 95 percent confidence intervals were calculated for trout (Carlander 1969). Estimation of instantaneous population growth rate was calculated (Ricker 1975) with significant values of correlation coefficients taken from a table (Steel and Torrie 1960).

Distribution of all fish caught is listed according to location.

RESULTS

Distribution

Rainbow trout were caught at stations 1, 2, and 3.
Sacramento suckers were caught in stations 1 and 3 (Table 1).

Table 1. Distribution of fishes in sections of Lights Creek, Plumas County, 1994.

	Station Number		
	<u>1</u>	<u>2</u>	<u>3</u>
Distance above creek mouth (km)	18	14.2	11.1
Rainbow trout	X	X	X
Sacramento sucker	X		X

Standing Crop

Rainbow trout was the only game fish caught in Lights Creek. Biomass averaged 1.4 g/m² at three stations. Biomass for rainbow trout large enough for anglers to catch and keep (127 mm FL and larger) averaged 0.6 g/m² (Table 2).

Table 2. Estimates of rainbow trout standing crop in Lights Creek, Plumas County, 1994.

Distance above mouth (km)	Population Estimate	95 Percent Confidence Interval	Biomass (g/m ²)	Estimate of Catchable Trout (≥127 mm FL)	Biomass of Catchable Trout (g/m ²)
18	45	42-52	0.8	3	0.3
14.2	117	94-145	3.2	16	1.4
11.0	14	13-19	0.1	1	0.1

Age and Growth

The formula $FL = -0.1 + 0.2 S$ describes the relationship between the fork length and enlarged scale radius (S) of 56 rainbow trout caught in Lights Creek. The coefficient of correlation (r^2) is 0.72.

Population growth was faster than mean individual growth in age 1+ rainbow trout (Table 3).

Table 3. Growth rates for rainbow trout caught in Indian Creek, Plumas County, 1994.

Age	Population Growth			Mean Individual Growth		
	Length Interval	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval	Difference of Natural Logarithms	Instantaneous Growth Rate Gx
	(mm)			(mm)		
1-2	69-139	0.700	2.101	80-139	0.552	1.657

Forty-one age 1+ rainbow trout averaged 114 mm in fork length and ten age 2+ rainbow trout averaged 163 mm in fork length (Table 4).

Table 4. Calculated fork length of rainbow trout from Lights Creek, Plumas County, 1994.

Age	No. of Fish	Length at Capture (mm)	Calculated Lengths at a Successive Annuli	
			1	2
1	41	114	69	-
2	10	163	80	139
Number of back-calculations			51	10
Weighted means (mm)			71	139
Increments (mm)				68

Length and Weight

Age group 0+ rainbow trout represented 67 percent of the catch. Age 1+ fish represented 23 percent and age 2+ represented 10 percent of the catch (Figure 2).

The relationship between length (L) and weight (W) of rainbow trout is:

$$\text{Log}_{10} W = -4.8 + 2.9 \text{ Log}_{10} L$$

$$r^2 = 0.98$$

$$N = 159 \text{ (Figure 3 and Appendix 2)}$$

Coefficient of Condition

We calculated the coefficient of condition and 95 percent confidence limits for a total of 159 rainbow trout (Table 8).

Table 8. Condition of rainbow trout in Lights Creek, Plumas County, 1994.

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
Rainbow trout			
0+	106	1.1199	0.6720-1.5677
1+	37	1.0684	0.8782-1.2586
2+	16	1.0171	0.8973-1.1370
Combined	159	1.0976	0.7127-1.4824

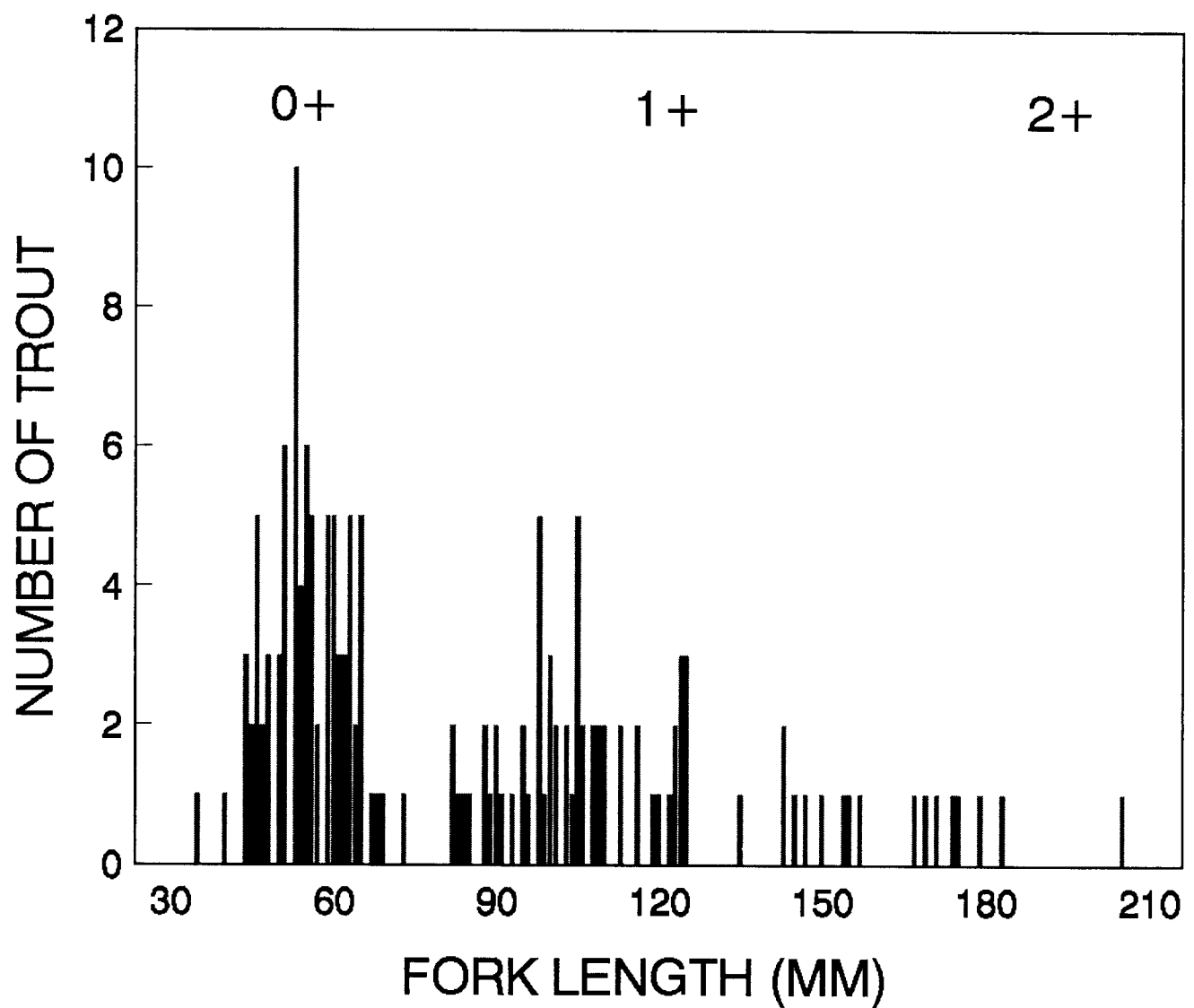


FIGURE 2. Length, observed frequency, and age of rainbow trout caught in Lights Creek, Plumas County, 1994.

The relationship between length (L) and weight (W) of rainbow trout is:

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$$r^2 = 0.98$$

$$N = 159 \text{ (Figure 3 and Appendix 2)}$$

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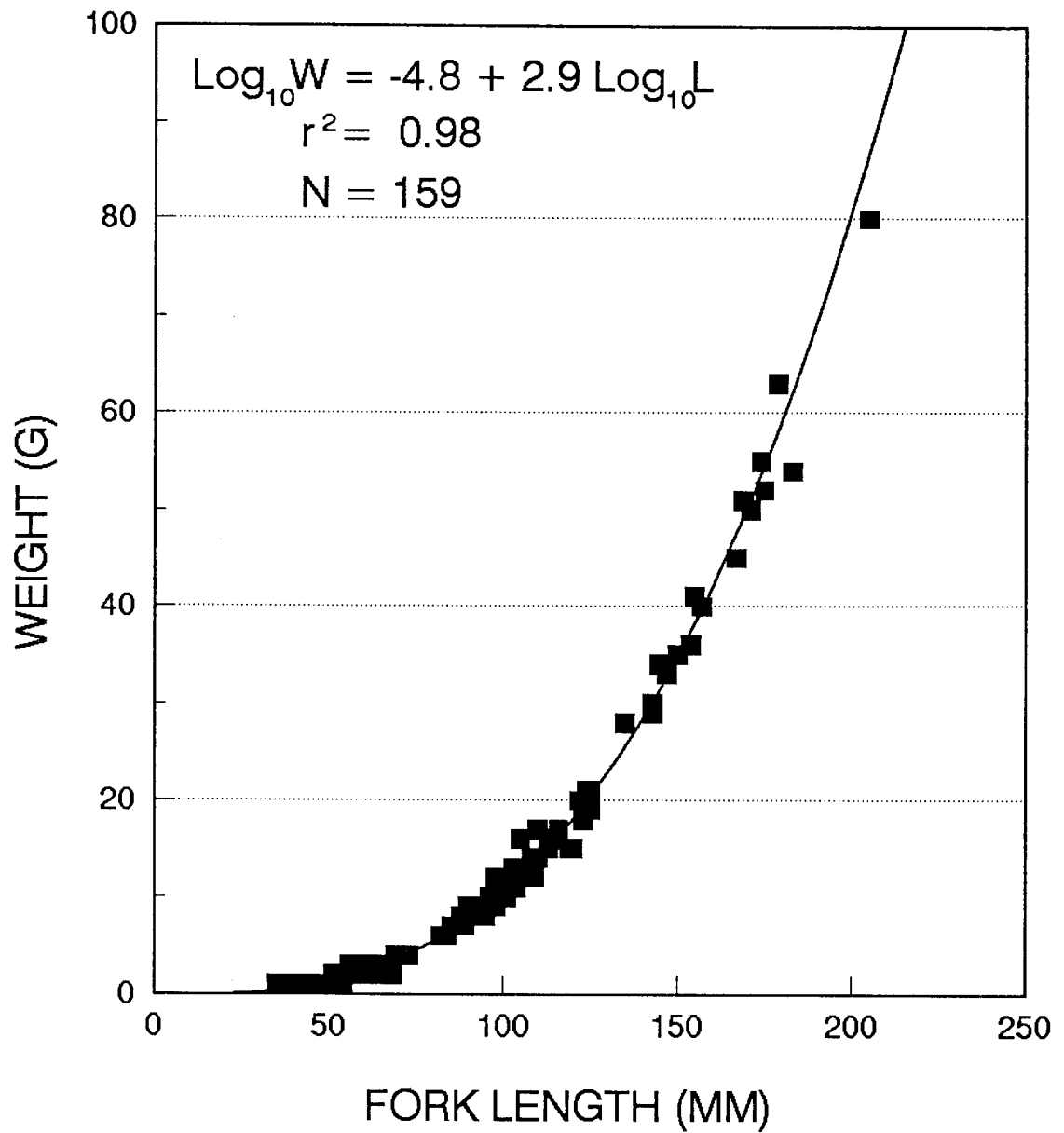


FIGURE 3. The relationship between length weight of rainbow trout caught in sections of Lights Creek, Plumas County, 1994.

DISCUSSION

We have sampled fish in five direct tributaries to Indian Creek (Brown 1992). All streams supported populations of rainbow trout. Population estimates averaged 83 rainbow trout per station. Biomass averaged 3.6 g/m² (Table 5).

Lights Creek has been altered by mining. Many of the trees that provide shade, cover, and nutrients through leaf drop have been removed. The substrate has been reduced to predominantly bedrock and cobbles. Habitat that could support trout has been greatly reduced.

Loss of habitat is reflected in low trout biomass. Lights Creek has fewer trout than the average for five tributaries to Indian Creek and lower average biomass (Table 5).

The only station we sampled that retained natural cover and canopy was station 2. That station had a much higher population (117) and biomass (3.2 g/m²) than stations 1 and 3. Population and biomass statistics from station 2 (Table 2) are more typical of the other small streams we sampled (Table 5). More fish were found in this station because trout supporting habitat was largely intact.

Table 5. Estimates of rainbow trout standing crop and biomass in tributaries to Indian Creek

Stream	Average Number of Trout	Average Biomass (g/m ²)
Red Clover Creek	49	4.6
Hungry Creek	76	2.8
Little Grizzly Creek	131	4.6
Ward Creek	101	4.4
Lights Creek	59	1.4
Average	83	3.6

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APPENDIX 1

FISH POPULATION STATIONS FOR LIGHTS CREEK, PLUMAS COUNTY, 1994

Station 1 - The lower boundary of Station 1 is on the East Branch of Lights Creek 10 m upstream from the confluence of Lights Creek and the East Branch. The station extends upstream 58.9 m. It passes under a road bridge. Station 1 is located at UTM 913 565 at an elevation of 1341 m MSL. The stream within this station is primarily riffle (80 percent) with a lesser component of ponds (20 percent). It has a surface area of 171 m² at 0.08 cms. Substrate is 60 percent cobbles, 30 percent bedrock, and 10 percent gravel.

Station 2 - The lower end of station 2 begins 38 m upstream of the confluence of Lights Creek and Superior Ravine and extends 68 m up Lights Creek. The station is located at UTM 899 530 at an elevation of 1219 m MSL. The surface area of station 2 was 428 m² at 0.08 cms of which 60 percent was riffle and 40 percent was pool. Substrate was 40 percent bedrock, 50 percent cobbles, and 10 percent gravel.

Station 3 - Station 3 begins 1127 m above the mouth of Moonlight Creek. It is located at UTM 885 502 at an elevation of 1146 m MSL. The stream within this station is primarily pool (70 percent) with a lesser component of riffle (30 percent) at 0.01 cms. It is 52 m long and has a surface area of 223.6 m². Substrate is 40 percent gravel and 60 percent fine material.

APPENDIX 2

LENGTH AND WEIGHT OF RAINBOW TROUT CAUGHT IN LIGHTS CREEK, PLUMAS COUNTY, 1994

Length (mm)	Weight (g)	Length (mm)	Weight (g)
35	1	65	3,3,3,3,3
40	1	67	3,3
44	1,1,1	68	2
45	1,1	69	4
46	1,1,1,1,1	73	4
47	1,1	82	6,6
48	1,1,1	83	6
50	1,1,1	84	6
51	1,1,1,1,2,2	85	7
53	2,2,2,2,2	88	8,8
	2,2,2,2,2	89	7
54	1,2,2,2	90	8,9
55	2,2,2,2,2,2	91	8
56	2,2,2,2,3	93	9
57	2,2	95	8,9
59	2,2,2,2,3	96	10
60	2,2,2,2,3	98	9,10,10,10
61	3,3,3	99	10
62	2,2,3	100	10,11,12
63	2,3,3,3,3	101	10,11
64	3,3	103	11,13
104	11	143	29,30
105	12,13,13,13,15	145	34
106	12,13	147	33
108	14,14	150	35
109	12,14	154	36
110	14,17	155	41
113	15,16	157	40
116	16,17	167	45
119	15	169	51
120	15	171	50
122	20	174	55
123	18,19	175	52
124	20,21,21	179	63
125	19,20,21	183	54
135	28	205	80

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40	1	67	3,3
44	1,1,1	68	2
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46	1,1,1,1,1	73	4
47	1,1	82	6,6
48	1,1,1	83	6
50	1,1,1	84	6
51	1,1,1,1,2,2	85	7
53	2,2,2,2,2	88	8,8
	2,2,2,2,2	89	7
54	1,2,2,2	90	8,9
55	2,2,2,2,2,2	91	8
56	2,2,2,2,3	93	9
57	2,2	95	8,9
59	2,2,2,2,3	96	10
60	2,2,2,2,3	98	9,10,10,10
61	3,3,3	99	10
62	2,2,3	100	10,11,12
63	2,3,3,3,3	101	10,11
64	3,3	103	11,13
104	11	143	29,30
105	12,13,13,13,15	145	34
106	12,13	147	33
108	14,14	150	35
109	12,14	154	36
110	14,17	155	41
113	15,16	157	40
116	16,17	167	45
119	15	169	51
120	15	171	50
122	20	174	55
123	18,19	175	52
124	20,21,21	179	63
125	19,20,21	183	54
135	28	205	80